

MASON (H.B.)

HOW

TO

BECOME REGISTERED.

HARRY B. MASON.

PRICE, 50 CENTS.



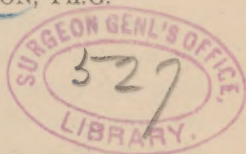
HOW TO BECOME REGISTERED.

DESIGNED AS

A Substitute for Professors and Instructors

WHEN THOSE IMPORTANT ADJUNCTS OF PHARMA-
CEUTICAL STUDY ARE BEYOND THE
REACH OF THE STUDENT.

By HARRY B. MASON, Ph.G.



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INTRODUCTION.

To direct the pharmaceutical student in his theoretical course of study; to awaken in him those perceptive faculties—perchance lying dormant—and bring them into daily training and use; to teach him to bring Theory and Practice into close companionship with one another, instead of widening the breach, as is, alas! too often the case; and to combine these three composite elements harmoniously and in approximately correct quantities, so that the result will be a compatible mixture of more or less pharmaceutical elegance which shall arouse latent admiration, and pleasure, and satisfaction in the State Board—these are the objects of this little book. But, though this be our purpose, we would early warn the prospective pharmacist from holding that desired hope up as the one sole point to be reached, which, when attained, shall entitle him to everlasting respect, without

further effort on his part. Instead, we would impress upon him, in as perspicuous a manner as possible, the at first seemingly stupendous fact that when he has pursued this course of study and has passed his State Board examination, he has but *learned* the art of studying, together with the practice necessary to combine book-presented facts in a practical manner.

But do not, we beg of you, allow this to dampen your ardor; instead let it be a strong light that will enable you to see the path you have determined to tread with more clearness, so that you may avoid falling over bowlders and into the holes that strew the way. For no State Board that we know of requires anything more than to be assured of the fact that you *know how to study*—that you have learned the fundamental, skeleton facts underlying all successful attempts at pharmaceutical study, and are capable of using them as so many keys with which to unlock the ponderous doors of Pharmacy. Now these statements may seem at first hard to believe, but they are nevertheless

truths. State boards cannot, and so do not, ask of an applicant that he or she be skilled in any one of the several branches composing pharmacy. What they require and what they get is this: A student must prove to them that he possesses the requisite knowledge necessary to a thorough comprehension of facts when he shall have occasion, through the daily exigencies of his calling, to look them up, or if studiously inclined, as they certainly hope he is, to pursue his studies in any or all branches with thorough and complete understanding. In addition, they of course expect him to be practical—to have practical knowledge; and this we shall endeavor to teach you by constant connection of practice and theoretical facts, as far as possible and expedient.

The reasons for these perhaps inconsistent facts are plain. Every student, no matter what his later intentions and purposes are, pursues at first the same course in pharmacy, chemistry, botany and physics, until the fundamental laws of each are comprehensibly digested. This must,

in the very nature of things, be so of necessity; for by learning a line of laws or truths common to all things and underlying their complete comprehension, we have that at our command which enables us to at once form correct and accurate conclusions; but on the other hand, if we learned each fact concerning a substance by itself, with entire lack of system and without knowledge of the laws or truths governing them all, and no idea of their connection one to another, we would only burden our memory unduly and unwisely, without increasing our knowledge to any great extent. But when we shall have reached the point where these laws and truths — these fundamental facts — are plainly understood and comprehended, there comes a divergence. We are then ready and able to follow any of the many paths spread out before our view; and no two classes of students will follow the same path, for they choose that which will the better serve their needs.

When you have completed the line of study herein prescribed, you have virtually

but reached that point of divergence. This is what the State Boards require to be assured of. They wish to be shown that you are capable of following any divergent ray—and their name is legion—streaming with unerring precision from out the ground work of your calling and reaching into the borders of infinity.

And, again, after you have been through this amount of studying, you have unconsciously acquired a studious habit. Your memory is better; your mind is without difficulty concentrated on your work; you arrive quickly at a comprehension of hard-rooted facts; you have, it is hoped, acquired a taste for study, a taste for delving into that which you do not clearly know or understand; you have trained your mental faculties so that they readily subserve your needs and demands; *in short, you have learned to study.*

We have now, we think, more clearly pointed to you the whirlpool we at first cautioned you to refrain from being—perhaps unconsciously—swept into, namely, the idea that having passed the State Board

examination all need of further study and self culture has ceased to exist. You can readily see that to be a successful pharmacist you must follow the paths which, though now misty, will then be perfectly clear to your mental vision, and combine skillfully the theory thus learned with the practice demonstrated in your practical work. Then, and not before, will you be following the course which cannot fail to make you a pharmacist worthy of the name, and so considered. And you *will* be so considered, for true merit is always recognized, and never fails to reap its reward in one way or another.

We do not wish this course to be considered in any way a substitute for a regularly prescribed college course, when such is at the command of the student. It is, instead, intended only for those who are unable, for reasons best known to themselves, to reap the superior advantages sure to accrue from a college training. To begin with, in a work of this kind it is impossible to embrace many features found in a thorough college curriculum; nor,

since its mission is to prepare the student for a State Board examination—or, in other words, to acquire in him a taste for pharmaceutical study—are they found to be actual necessities; for when he shall have finished his course, he will be perfectly capable of following any line he considers necessary. And then, again, home self-teaching can at best compare unfavorably with instruction by competent professors and instructors, who are continually pointing out accurate ideas and steering the student clear of inaccurate conceptions. The enforcement of practical work some colleges now include in their curriculum is also far beyond any laboratory practice to be had in the best of pharmacies. But the earnest and untiring student will largely fill these discrepancies according as he is able and sees the need of so doing.

Before entering upon a consideration of our curriculum, we would warn you against endeavoring to begin any study in pharmacy until you have laid a foundation of thorough school education upon which to

build; for if you have not, success will surely not attend your efforts, and you will be thrown back upon your ignorance, irresolute and discouraged. A prospective pharmacy student should *at least* be thoroughly versed in mathematics, have a fair comprehension of Latin (declensions, conjugations, translations), and a good knowledge of history and geography—it is taken for granted that his English is *par excellence*! If you have not these at your command you will be seriously hampered by their lack; for Chemistry, the groundwork of Pharmacy, will open its gates to the puzzled seeker after knowledge only after becoming aware of his mathematical skill; Pharmacy's nomenclature will yield only to him who has a fair command of Latin; and Botany and Materia Medica require of the student a knowledge of history and geography.

And, besides, it takes knowledge to enable us to assimilate knowledge; unless it were for the previous feeding of the mind with knowledge, it could not now do the work; therefore, the curriculum must ac-

cord with the idea of a happy synthesis of new facts and old experience. Assimilation of facts, derivation of principles, rules or generalization, application of laws to new facts, are constant stages in the development of the human mind from childhood up, and unless it has been accustomed to this work it will ignominiously fail of its duty.

This course is divided into three main divisions, and although each have many subdivisions, those necessary for our purposes are summed up under their respective fountain heads to admit of greater facility and convenience. The subject matter is so divided that there are one hundred lessons in each division or branch, one of each of which is given every successive week; thus requiring one hundred weeks or two years, approximately, for its completion. This gives you three lessons per week and two days in which to study each. As there is an average of *only three to six pages* of matter in each lesson, you have ample time in these two days to thoroughly master it. Though the course

in the aggregate may look to you stupendous in its requirements, you can readily see that it is an optical delusion, for you have only two or three pages of matter daily for a period of two years, besides time for occasional reviewing. *So do not for a moment allow first impressions to discourage you.* When you once get fairly started you will readily see that it will take very little of your *time*, but considerable of your *thoughts*. Refrain, then, we conjure you, from allowing premature impressions to shape your course until you have proved their fallacy by putting them to the test. Begin with a determination to tread the path every step of which will be plainly outlined for you, and we have no fear but that, once having fairly begun, you will continue, that is if you have a spark of ambition anywhere in your make-up, and we hope you have sufficient to cause spontaneous combustion among the cobwebs at present dimming your vision.

As we have said, there are two days given you for each lesson. This is certainly ample time in which to study thoroughly

every point of importance, and you will find that if you are thorough, you will remember them all easily when reviewed. Don't *read* the matter over, but *study* it, memorize it, using every spare minute you have to advantage, as though you were preparing for regular quizzes. You would if you were at college, and you must if you expect to be successful. Use your imaginative powers and persuade yourself that you will be compelled to go before the instructor and prove to *him* whether or not you have learned your lesson. Stretching your imaginative powers still farther, consider yourself your own instructor, and in that capacity ask of your friend, *the student*, those questions given in some of the text books (Clarke, Remington, etc.), but which if not given are easily formulated after a little practice; meanwhile treating your revered instructor with the respect due his position. Wholesome fear of those who we must answer to are *such* powerful incentives to study!

You will soon find that by this method of self-quizzing you are perfectly capable

of testing your own knowledge accurately; and it will prove indispensable to you in the furtherance of your work. If you find by diligent self-questioning that you have not arrived at a full and thorough comprehension of the present lesson, then *go back and study it until you have reached that point.* It's no monster task to memorize the main features of two or three pages of matter in a day; it requires only such time as you can conveniently spare from your duties; but it does require that that time shall not be wasted.

After learning the present lesson, review the last one in each case, so that each week you will be reviewing one week back. This will be of lasting benefit to you and will take but a few minutes if you have done your work thoroughly in the first place. Every three months give up a week to reviewing of all points gone over, omitting the general weekly lessons for the time being, and see that you are well posted on ground already covered. It is far better to go slow and comprehend as you go along; for a thing once learned

has but to be reviewed to be brought back forcibly to the mind. Build the foundation firm and solid, and the superstructure, *which shall be seen*, will conform to its qualities: if weak, it will be weak; if able, it will then be able; if large, liberal and firm, it will be likewise. As you desire your superstructure to be, so build your foundation.

At the end of the first year, give up two or three weeks to a thorough reviewing, and more, if necessary, until you feel that you know every point of importance that you have studied. Know and have thorough command of your first year's work before entering upon the second year's study, even if you lose (?) two months by so doing. There is no hurry, and you will gain time in the end by stopping occasionally to cement the crevices. A small rift soon gains tremendous proportions, and if you would escape its danger, prevents its growth by making it whole while yet small.

Pursue the same diligence and self-questioning through the second year, have

the same quarterly reviews, and at the end thoroughly review both years, giving up freely all the time necessary for doing it thoroughly.

If after these two years of study and culture you are able to tell the substance of what you have gone over; have become thoroughly conversant with the bearing those things learned have upon the daily duties of the store; have not lost sight of the *practical* side of your calling; are able to handle the pharmacist's "implements of war"—the mortar and pestle, pill-tile, test-tube, burette, etc.—with deftness and skill—then *you need fear no State Board examination in existence.*

PART I.

First Year's Study.

PHARMACY.—*Remington's Pharmacy*, Third Edition, to Part III., and including pages 1082–1153.

CHEMISTRY.—*Steele's Physics*, entire, first fifteen weeks: *Fowne's Chemistry*, pages 131–274, remaining thirty-five weeks.

BOTANY.—Completion of *Gray's Lessons in Botany*.*

I. PHARMACY.

Take Remington's excellent work and divide its 438 pages preceding Part III., and its 72 pages in the back of the work between pages 1081 and 1153, making 508 pages in all, into fifty divisions having a like number of pages, and mark them for

* See publishers' cards in the rear. The publishers of "How to Become Registered" would be only too glad to be of assistance to you in procuring such books as are not there mentioned.

future reference—or remember the actual number of pages each division represents. Each division thus marked shall constitute your lesson in pharmacy for the week. This systematizes your efforts and adds materially to your advancement, since you know what is expected of you each two days, and can rest content when that is done to your entire satisfaction.

After you have become familiar with the nature, uses and qualities of the dispensatories and pharmacopœias, you will be confronted with metrology—weight, measure, specific gravity. You will need to thoroughly familiarize yourself with the metric system, for the last edition of the U. S. P. adopted it, and it is only a question of time when it will be universally adopted. Considerable practice in this respect will be necessary, in converting from one system to another and back again, for you will be eventually compelled to calculate doses, etc., in the metric system, and much converting will at first be necessary. If you have not a set of weights at your command, it

is advisable for you to get them without delay and grow familiar with them and their equivalents in the other existing systems.

Specific gravity is comprehensively set forth in Remington, and along with its study you need to carry its teachings into effect, by actual use of hydrometers, specific gravity bottles, the westfall balance, etc.; consulting the alligation method in making calculations. Specific gravity has an important bearing upon pharmacy, and you will do well to appreciate it.

After brief chapters on heat—of which the consideration of thermometric conversion is especially important—and vaporization, your next step is a consideration of distillation. In the study of this carry your theory into practice by distilling some water in a retort—a glass one will do. For there is a vast difference between reading of the methods employed and carrying them into effect.

Sublimation is important to the manufacturer only, but you should be conversant with its scope. Dessication may or

not come within your province ; however, knowledge of its objects is of benefit to you. You should become conversant with those subjects that do not appear to have a direct bearing upon your work, for you will encounter them in an examination.

Communion is quite important, inasmuch as a day hardly passes but what you are called upon to perform one or more of the processes within its province.

In connection with your study of solution, you should endeavor to get approximate ideas of the solubilities of official substances in water, alcohol and other solvents. This practice you should continue until it grows to be one of the many habits necessary to the better mould your nature into paths of observance and quick conception ; having an approximate, if not accurate, idea of things as they are continually springing up, sometimes requiring quick thought on your part without the opportunity of consulting your books. This—the daily consideration of solubilities—and other subjects analogous to it in their

immensely practical bearing, as we shall mention later, should be carried out of the text books and right into actual, everyday practice. Every time you have occasion to dissolve a chemical substance in a solvent, consult Remington as to its solubility, whether absolutely necessary or not, and you will, by thus learning one at a time, soon grow familiar with them all. The endeavor to memorize them all at one time from the text book will certainly prove futile; they can only be learned gradually.

Following the chapter on solution, there are several chapters on various pharmaceutical manipulations. These are all of more or less importance, but are plainly set forth and need no comment to aid you in their consideration. It must not be thought that in offering these hints, and comments, and advices, we are covering all points of importance, and all that will be necessary for you to study. Far from it. We are, instead, endeavoring to *uncover* those points of especial importance along the way, which might otherwise be overlooked

or given scarce consideration : and also to be of aid to you in your consideration of those that are difficult as regards their treatment.

Percolation is of paramount importance, for it is resorted to more than any other operation in galenical pharmacy : and certainly more preparations are direct outcomes of its process than, perhaps, all other processes together. You should learn the theory underlying its action and apply its teachings practically, under different conditions, learning the pharmacopœial requirements. Much practice is necessary in order to become an adept at percolating.

We come now to a consideration of preparations. This may at first appear difficult to you, for you do not know how much to learn or what to memorize of the mass of condensed material before you. You should have an approximate idea of the number of preparations in each class ; the object of each distinct class, or, the reason for the selection of the menstruum peculiar to each class (for instance, "the

medicated waters are used as pleasant vehicles and solvents for the administration of various remedies, and are solutions of various volatile oils in water"); the superiority, in some respects, of one class over another (as the tinctures, in some respects, are superior to the fluid extracts, and *vice versa*); the methods of preparing different preparations of the same class; and the difference between the methods of preparation of the different classes: an approximate, or better, accurate conception of the strength of the more important preparations, of whatever class they belong to (as the opium preparations, for instance, learning the amount of opium in each preparation), or, if a class have a like strength, that strength should be memorized (as the vinegars, for instance); the component parts of the more common and important preparations, as far as practicable, without burdening your memory with accurate knowledge of the quantities of the different constituents: the peculiarities, if any, of any one preparation in a class (as, for instance, the use of tartaric

acid in the preparation of tincture of aconite). You should, if possible, get some idea of the menstruums used in the preparation of the different tinctures and fluid extracts, so that in adding a diluent to them in a prescription, you may at times avoid unsightly precipitation. Indeed, in any such case it would be advisable to consult Remington, and thus gradually grow familiar with the more important ones.

II. CHEMISTRY.

Before entering into a consideration of chemistry proper, you need to pave the way to a correct understanding of its laws by a preparatory course in physics. Steele's work is a handy little book, not voluminous, and covers the ground in a fairly commendable way. You can readily go through it in fifteen weeks, the time allowed you for its consideration.

Fowne's chemistry, latest edition, is your next step, using only pages 131 to 274, and dividing these pages into as many

divisions as there are remaining weeks in the year—thirty-five.

The main part — as regards pages — of this year's chemistry will be a study of the non-metallic elements. There are certain things to be learned of each element, as you will find as you take up their study; such as their properties, atomic weight, symbols, and many other points of importance.* But we would advise you to cover this ground as quickly as is consistent with good results, so that time in plenty may be given up to a *thorough* consideration of the last two chapters in this year's work—"Chemical Affinity," and "The Atomic Theory." This will appear to you to be the hardest part of your course in chemistry, either during the first or second year. But upon your success in these very lines depends your further progress in the study of chemistry; so thoroughly master it now while considering it. That which appears hard and

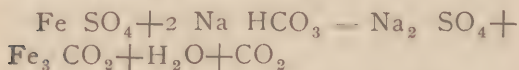
* In this connection it will be well to read over the article relative to next year's chemistry. Some points are there given — because considered more appropriate, for various reasons — which will be of value here.

difficult to you at first will gradually grow clear to your perception, however, and you only need to apply yourself persistently to it and, like everything else, it will succumb to your energy.

In connection with your study of these chapters, you need to practice the continual writing of equations, taking later the compounds which, upon being united, unite by other than mutual decomposition—i.e., base for acid and acid for base. For instance: When sodium carbonate and calcium chloride are brought together, mutual decomposition results:

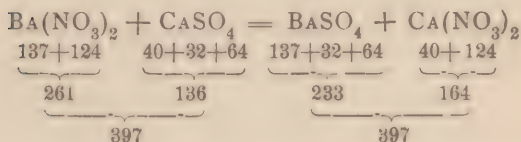


But when ferrous sulphate and sodium bicarbonate are brought together, this mutual interchanging of basylous and acid radicals does not ensue:



You should substantiate the result of your equation writing by reference to the text books where many of these are given under the salts of their respective metals,

and in various other places. You should also calculate total of molecular weights of compounds before and after the reaction as expressed by your equation, and, if the results agree, your equation, barring other errors not so likely to happen, will be correct. For instance :



The resulting compounds in a reaction should always have the same sum total of molecular weights as before the reaction ; in other words, nothing is ever lost.

An important point at this juncture is a consideration of percentage composition. This is the relative amounts of the different elements in a compound, according to their atomic weights. For instance, suppose we wish to know the percentage composition of potassium nitrate. The molecular weight of KNO_3 (the sum total of atomic weights of all constituent elements) is as follows: K—39, N—14, O_3 —48 ($3 \times$

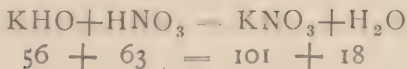
16) = 101. Therefore, since the atomic weight of potassium is 39, the per cent. of K present in KNO_3 , whose molecular weight is 101, is expressed by the following proportion :

$$39 : 101 :: X : 100$$

And we could as readily get the percentage of oxygen and nitrogen present by the same method, using their atomic weights in forming our proportion. Thus it is an easy matter to determine the percentage of metal present in any of its salts, or alkaloid strychnine in its sulphate, etc.

Another valuable feature in connection with the consideration of these two chapters in Fowne, is the calculation of quantities necessary to produce a given chemical change. This will, at first, prove difficult to you; and here is where your mathematical training will prove invaluable. Let us illustrate. We have 10 lbs. of potassium hydrate to be converted into potassium nitrate, and we wish to know how much nitric acid will be required to produce this change, and also how much potassium nitrate will be produced. The

equation illustrating the reaction must first be written :



From the molecular weights of the above compounds we find that if we are to combine KHO with HNO_3 , we must bring them together in the proportion of 56 of the former to 63 of the latter. From this we form our proportion :

$$56 : 63 :: 10 \text{ lbs.} : X$$

and find as a result that $11\frac{1}{4}$ lbs. of HNO_3 are required to neutralize the 10 lbs. of KHO. Now, we wish also to determine the quantity of KNO_3 that has been produced. We go back to our equation and find that for every 56 parts KHO used 101 parts of KNO_3 are formed, and by simple proportion

$$56 : 101 :: 10 \text{ lbs.} : X$$

we find $18\frac{1}{2}$ lbs. will be the amount produced from the 10 lbs. of the KHO used.

III. BOTANY.

Gray's Lessons, complete, will suffice as a text-book for your study of botany, as far as present needs are concerned. This part of the course is largely didactic : there is the book containing the laws of plant life, their functions, etc., and you have to learn about all there is between its covers. But it is small and you have only about three pages to a lesson, and certainly two days is time in plenty to thoroughly familiarize it. We can, at best, but give you a few hints concerning the main conceptions, which you should keep constantly in view.

1. Familiarity should be gained with the growth and life of plant forms and with their names.

2. Acquaintance with plant organs and their descriptive terms should be had, and this exercised by comparison of the pharmacopeial descriptions with the crude drugs themselves, until by reading a description of a root or a leaf in the U. S. P. or elsewhere, you readily form in your mind's eye its physical appearance.

3. Cognizance of the uses of organs or parts of plants in their morphological variations, and of the organ or organs of which they in their varied forms are but guises, is essential to a thorough knowledge of botanical life: it is this which underlies morphological botany.

4. You should also acquire some familiarity with the classification of plants, so that you will not be "at sea" when some order is spoken of in connection with a given drug.

It is truer of botany than of any of the other studies herein prescribed, that when you have finished the botanical study outlined in this course, you have but barely reached that line of divergence spoken of in our Introduction. You have, at best, but learned a few underlying principles and facts, which will be of aid to you should you become interested and take up the study of Morphological Botany, or Systematic Botany, or Physiological Botany, or Vegetable Histology. But enough has been learned to make clear to you the descriptions given in the U. S. P., enabling you to identify many specimens

of unknown identity and to discover the presence of adulterations as far as they can be identified by their external characteristics.

Before closing the work in botany, it is desirable that you should become somewhat familiar with the structure of plant tissues as seen under a simple microscope. For this purpose a simple microscope set in a rubber frame and having two lenses, costing not more than a dollar and a half or two dollars, will suffice. In using this, the highest power or strongest lens should always be turned toward the object. Simple directions for procedure are given in a chapter on this subject in Gray, and you can do no better than to follow its plain teachings. You have probably ere this decided that botany is a pretty dry study and only consists of "needless memorizing." But you cannot fail to become highly interested in this branch of the work, if once you get started. So do not, we conjure you, refrain from considering it because you did not find your former botanical study an edible dish.

You will soon become familiar with

tissues as seen under the microscope and cognizant of its importance in other directions. You are then ready to undertake the gradual acquisition of microscopical knowledge necessary to your next year's work in *materia medica*.

No pharmacist of to-day can hope to be considered educated in his profession until he knows the uses of, and is familiar with, the microscope, and is capable of directing its teachings to the exigencies of his calling.

PART II.

Second Year's Study.

PHARMACY.—*Hcebner's Manual of Pharmacy*, beginning at Part II., and completing the book, using meanwhile *Remington* for general and explanatory reading, and the *Pharmacopæia* for reference, tests, etc.; reserving five weeks at the close of the year for *Hartt's Volumetric Analysis*.

CHEMISTRY.—*Clarke's Chemistry*, beginning with the metals on page 172, and completing the book, using *Fowne* for general and explanatory reading.

MATERIA MEDICA AND PHARMACOGNOSY.—*Maisch's Organic Materia Medica*, complete, using the *Dispensatory* and *Pharmacopæia* continually as references.

INTRODUCTORY REMARKS.

It is to be hoped that you have pursued your first year's study with avidity, using your ultimate success as a hope to restore

your flagging mental footsteps when all seemed blackest chaos around you ; have pertinaciously surmounted every obstacle, until you have now as an early reward a somewhat firmer grip on the handle of pharmaceutical study. Your work thus far—if, indeed, you have gone thus far—has been a constant struggle between the hope of reward and the inertia of doubt. We know how hard it is to patiently saw away at a log that seems to us unyielding knots and snarls, when there is no one by to teach us how we may so poise the instrument as to easily sever it, giving us a clear view of its intricate interior. But if you have bravely kept up with unswerving fidelity to your better judgment thus far, you have passed the crisis and henceforth all will be comparatively plain sailing. You have learned to probe misty facts to their foundation : to seek the philosophy of all things by endeavoring to learn the fundamental laws which control their action, their objects. This is the keynote to all successful attempts at study.

A point formerly escaping hidden now

stands out prominently because of your awakened perceptive faculties ; its importance is seen at a glance, and its reasons for existence are learned at once. This is where reference to the larger text books is often necessary, in order that those points of importance hardly touched upon in the smaller works may be fully looked into. Here is where Remington will clear up many a misty vapor—where the dispensatory will give you fuller detail—where Fowne will make plain the intricacies of organic chemistry.

I. PHARMACY.

Heebner's Manual is given you for this year's consideration of pharmacy because it is largely devoid of extraneous matter necessarily contained in the larger books ; because useless repetition is avoided, and those points necessary for this year's study are summed up conveniently ; because its condensed form is excellent for presenting points or questions which can be looked

up thoroughly in Remington and the other works, and then studied or *memorized* in Heebner's.

Your first year's study of chemistry has prepared you for the study of the inorganic acids and following subjects. You can now understand the equations representing the reactions ensuing in the manufacture of an acid, and are capable, if necessary, of calculating necessary quantities to be used and the amount of product produced.

7. The *specific gravity* of each acid, the *manufacture*, *percentage strength*, *properties*, are points to be learned. Beside this, you should know their common impurities and the tests for them as given in the U. S. P. These you should apply yourself and substantiate facts stated, thus familiarizing yourself with chemical testing and enabling you to remember the impurities and tests with comparative ease. A test merely read and mayhap memorized soon fades from the memory or becomes hopelessly mixed up with others—and there are hosts of them. Remington is here useful

in making clear difficult chemical operations and dwelling at length upon them.

Next in order come the metals and their compounds. No complete plan can be laid out to be strictly adhered to in this study, but a few hints may not be amiss.

You should become somewhat familiar with the manufacture of the main salts of each metal. Thus, potassium has four or five important salts: the iodide, carbonate, nitrate, hydrate, and seidlitz powders—a double tartrate. Now, in this particular, Remington describes their preparation at length, giving exact quantities and dwelling upon each step of the process. This would be absolutely necessary were you to *make* these salts, in which case it would be invaluable as a reference and guide; but it is utterly impossible to remember all those things, and a great share of it is useless to the student. Therefore, after reading it over carefully in Remington, you can *memorize* the brief description in Heebner.

Then, the properties of the more important ones should be given some atten-

tion, though present memorizing in each case would not be fruitful. We purposely dwelled at length, while considering solution last year, upon the importance of learning the solubilities of the different chemicals *gradually*, so that you might be alive to the necessity of acquiring that knowledge by degrees, and in such a way that it would be permanently fixed upon your memory—by constant every-day reference as occasions arise. You ought, hence, by this time to be somewhat familiar with the solubilities of the salts, and your consideration of them now, in this connection, should be attended with good results.

What we said about impurities of acids, applies also to the salts. Using the U. S. P. for your *standard*, you should perform all those tests of importance, as far as possible, giving especial attention to those tests which distinguish a poisonous salt from one comparatively harmless, and those establishing the presence of a harmful impurity in a salt otherwise innocuous. Noted examples of these two cases are

the tests prescribed for the distinction between calomel and corrosive sublimate, and for the presence of one within the other. Such important tests as these should be secured beyond any chance of slipping their halts and escaping from the memory.

Another important point is the noting of antidotes for such salts as are considered poisonous, and the actual knowledge of the safe doses of such salts. Doses is another thing that is best learned gradually, in the main, but a few of the more important ones should be memorized while treating them in this connection. This knowledge is invaluable in prescription work, that you may guard against possible errors that creep into your orders. Antidotes for many of the poisonous salts may be found in Heebner, but reference to the dispensatory will give you adequate information. *Again, we say it is important that you should know the doses and antidotes of the chemical poisons.*

The prefixes and their use should be learned, if not already acquired; and this

is important, for they establish the relative strength of a salt. Thus, corrosive sublimate, a poisonous salt, is prefixed as Bi or Per chloride of mercury; while calomel, comparatively innocuous, is prefixed as Sub or Proto chloride of mercury. This is a favorite topic with examining boards.

Your study of the reactions ensuing in the preparation of the different salts has been of benefit to you, if you have exercised your perceptive powers, in forming ideas as to the liable chemical action resulting when certain substances are brought together, as in a prescription. But you will need to supplement this somewhat sparse knowledge by a careful consideration of Incompatability as set forth on page 1065 in Remington. After you have thoroughly digested this chapter, turn to the preceding one on Prescriptions. The first thing here to do is to memorize the Latin terms there given; after which your practical knowledge will be augmented by a careful perusal of the remainder of the chapter devoted to peculiar prescriptions. We say, memorize the

Latin terms, but that is also a matter of gradual acquirement, and you will find it necessary to refer to them at odd times afterward, as you find your mind aimlessly wandering in that direction.

And one more point: Get approximate ideas of the number of drops in a fluid drachm of different liquids. A list of these are found in Remington. This is important, for a wide difference exists between drops and minims of most liquids; and it is a favorite theme with State Boards.

Next in order comes a consideration of Organic Pharmacy. The same is true of these preparations and substances as has been of inorganic compounds, as regards treatment in their study; and, as repetition is unnecessary, we forbear offering any suggestions in this connection.

You have now remaining a few weeks' study of Volumetric Analysis, which shall complete your course in pharmacy. "Hartt's Volumetric Analysis" is a good work, but any other small treatise will do. Remington is hardly explicit enough in

this matter. You need to become familiar with the operations, the calculations, etc., attendant upon its study. We would advise your making up some normal or decinormal solutions, and applying the tests personally, for you will never understand Volumetric Analysis if you do not. It is not difficult, once you understand it, and a knowledge of its methods gives you greater facility in analytical work.

II. CHEMISTRY.

Last year you studied the non-metallic elements; this year you have to consider the metallic elements. It may appear to you, upon first getting started, that pharmacy and chemistry are this year needless repetitions of one another, inasmuch as the metals appear to form an important part of both studies. But they are treated each in its own way; in pharmacy you have not much, if anything, to do with the metals themselves, only their salts and compounds demanding your attention; but in chemistry the metals themselves and not their salts are considered, although a few salts of each are casually mentioned.

There are a few things concerning each metal to be learned. First, the symbol, atomic weight, valance and specific gravity; second, the source—its ores, etc.; third, preparation; fourth, physical and chemical properties; and fifth, the tests by which each metal is recognized in its compounds and distinguished from other metals.

The atomic weights must be known before we can form chemical calculations, as we pointed out last year; the valance must be known before a chemical formula can be correctly written; the symbols must likewise be known in attempting to illustrate reactions by equation writing, or before we can even write a formula. The sources, preparation and physical and chemical properties do not seem to have such a practical application just at present, but are nevertheless necessary to a well-rounded knowledge. You must remember that you are but laying the ground-work now, and though some things may appear to you inconsistent and unworthy of notice, because not having a direct bearing on the daily duties of the store, they are nevertheless important to complete your structure. You would certainly feel humiliated beyond measure if upon preparing to jump into the

fathomless future from off this platform of two years careful (?) construction, vain-glorious of its solidity, the very corner you had selected to spring from refused to bear your weight, and breaking, allowed you to fall down beneath its very foundation, crippled, perchance, beyond reparation.

The consideration of the physical and chemical properties of the metals can best be prosecuted by *comparison study*. Suppose you have, one week, learned the properties of silver, the next those of calcium, and so on for a few weeks. At first no danger would be scented, but after a few weeks you would get hopelessly "muddled" and unable to tell the properties of a given metal if you racked your brains until eternity. But if, instead, you would *compare* the properties of the metal under consideration with those of the ones already considered, thus keeping all clear as you go along, you would avoid this cleverly concealed rock.

Thus, taking the property of color, for instance, we find upon comparison that most of the metals are white, of varying shades. It is nearly pure in silver, platinum, cadmium and magnesium; yellowish in tin; bluish in zinc and lead; gray in iron, and reddish in

bismuth. The only decided exceptions to the white and its varied tints are gold and calcium which are yellow, and copper which is dull red. And so you may go on with all the other properties peculiar to metals.

As regards testing you should find three, or four, or five tests, as the case may be, for each metal, by which it could be distinguished in its compounds, and apply them all, if possible, until you are familiar with them. You ought, also, at this stage, to follow some scheme of separation by which the metals are arranged in groups, separated and tested, thus establishing their identity. This enables you to begin with an unknown substance (metallic) and discover its identity, whether containing the salts of one or more metals, and guards against possible admixtures of others not suspected as being present—if the scheme is followed out accurately and carefully. As the books prescribed in this course do not contain this scheme of separation in any form, we would advise you to procure some special book especially for this purpose, and prosecute the matter in this connection. We know of no better elementary treatise than that given in the rear of Steele's Chemistry.

You may think that you have already gone

over enough testing in your pharmacy study; but your treatment of it in this connection gives you the fundamental basis from which to work; it gives you the *key* with which to prosecute testing in any direction.

You have now, for the remainder of your course in chemistry, to consider organic chemistry. This will probably prove hard and difficult. But between Clarke and Fowne you will hammer it out to the proper consistency after the expenditure of more or less energy. As the points are touched upon in Clarke, generally but briefly, refer to Fowne for fuller explanation and detail. Much the same procedure is to be followed in this as in your study of the metals, as regards methods of study and points to be considered. You will occasionally find full and complete information in the Dispensatory on some subject treated but lightly in Clarke. Neither Clarke nor Fowne were intended solely for pharmacy students, and for pharmaceutical treatment, after you have learned the theory, the Dispensatory is an able ally.

Here again is clashing apparent between pharmacy and chemistry; but chemistry teaches you the laws and connections between known facts; while pharmacy tells you them

as they are, without troubling to explain their existence or connection. Hence the instruction by the two masters blend harmoniously together and round out fully your knowledge of the subjects treated.

III. MATERIA MEDICA AND PHARMACOGNOSY.

Maisch's Organic Materia Medica is given you as a guide for this study. You will soon find that a good memory is here an essential; but you will aid it largely by your method of study. Maisch, alone, will prove a little too condensed for practical study, and necessitates too much memorizing of points there set forth; therefore frequent reference to the Dispensatory will prove a valuable aid.

There are some things regarding each and common to all drugs you will need to learn. The habitat, origin, main constituent (as well as an idea of the others, so that you may avoid unsightly mixtures at times, in dispensing), medicinal and physical properties, and dose of each should be known. A knowledge of natural orders is useful, as we pointed out to you last year in botany, for often certain properties run through nearly

all or many plants in an order. A valuable point at this juncture is the learning of the synonyms of each drug. This is important, for drugs are generally called for by the laity by their common names—a deplorable fact, but nevertheless a true one; hence you should be as familiar with their common as with their correct, or scientific, names. This is a favorite subject with State Boards, and rightly so, too, for it is a subject of vital importance. The Dispensatory will furnish you the desired information.

Then there are facts regarding many of the drugs peculiar to themselves which need to be assimilated also. What we said about doses and antidotes in speaking of the poisonous salts, also applies to the tonic organic drugs. This is important in more ways than one; and it is a subject you may *always* expect to encounter in a pharmaceutical examination.

The medicinal properties are, it must be confessed, somewhat difficult to learn, for it seems as if some drugs are “cure-alls,” so many properties are ascribed to them: But here is where the comparison method of study, as pointed out to you in speaking of chemistry, will prove an invaluable aid.

By asking yourself the habitat, or dose, or medicinal property, or origin of a drug, you can soon determine whether or not you have learned them satisfactorily; and this method is about the only one of determining your progress. You should be continually asking yourself these questions of those drugs already considered as well as those under present consideration, in order to guard against possible (and probable !) forgetting of those facts already learned.

As regards the learning of the physical properties of drugs, it will be useless for you to endeavor to learn the "book descriptions." The only method that can possibly be attended with good results is the comparing of the drug itself with the description in the U. S. P., using that work in preference to Maisch in this particular. Here is where the purchasing of a cabinet of crude drugs is advisable, though not *compulsory*—if we may be allowed to use that term. You should give considerable attention to this branch of the work, for you will often be called upon in examinations and elsewhere, to identify crude specimens and to distinguish the commoner and easier told adulterations. In this connection you should prosecute the study of

microscopy began last year in botany. You ought by this time to have become accustomed to the use of the instrument, and capable of entering into its practical use with advantage.

The first thing to do is to become familiar with familiar objects and their appearance under the microscope. You must become accustomed to the appearance of a leaf, section or powder under the instrument before you can hope to detect the presence of an adulterant by its different appearance. The U. S. P. will be your guide in this matter, as in the testing for adulterations and admixtures in salts and acids. In studying drugs thus under the microscope, those light in color should be placed against a dark background, as black paper for instance; and vice versa with dark colored specimens; for contrasts between specimen and background are superficial aids in microscopic examinations of this character. You have in your previous year's work learned the terms used in describing leaves, roots, etc., and so in substantiating the description of a leaf described as "hairy, silky pubescent," you are not thrown back upon your ignorance. Your last year's work now clearly appears to you as a paving of

the way for a thorough understanding of this year's more difficult work; though its usefulness at that time may have been a matter of doubt with you.

Much practice is necessary before you become proficient in the use of the microscope, and it is advisable to follow its use throughout the entire year of your materia medica study. At the end of this time you should become quite used to its work and with the appearance of many adulterants, so that you may be able with little trouble to identify them. We have purposely refrained from mentioning to you such operations as require special preparation of the specimen to render it suitable for examination, and also from considering the use of the compound microscope, which will be necessary before you go much further.

Those are the next steps in your microscopical work, and your progress will dictate to you the necessity of entering upon a consideration of them when you shall reach that point. But, since that does *not* come directly within the province of this work, instead, being your next step after you shall have finished this course, we must drop the subject at this point. But we would impress upon

you the importance of microscopical knowledge in your profession. The ability of ascertaining the identity and qualities of drugs and chemicals; the exercise of knowledge and skill in the direction of scrutiny and discrimination; in short, precise and accurate knowledge of the substances under his supervision—these are the pre-eminent requisites of the modern pharmacist. These are the directions in which your future efforts must be expended, if you would attain usefulness in your profession; and the artificial aid rendered by the microscope, test-tube and balance can not possibly be dispensed with in prosecuting these efforts to attain a reputation.

CLOSING REMARKS.

If you have followed out safely the preceding course, and gained registration as your reward, as you certainly have if you have proved faithful to your better judgment, let us again point out to you the fact that you have but *prepared* yourself for the effort that shall decide your future success as a pharmacist. If you do not make this effort, which you can plainly see needs to be made, then

be prepared to, sooner or later, fall into innocuous desuetude. The almost hourly discoveries made by men whom we should all strive to emulate, prove to us the swift advancing of the current of deep thought rushing down upon the boat in which we have embarked for life, and show us the necessity of plying our oars with renewed energy, else we float down the stream only to be becalmed in some curling eddy, helpless and indifferent.

Abraham Lincoln once said: "These are the days of exacting competition; days when moral courage and brain power count; days wherein there can only be a survival of those who are mentally and physically the fittest." As the years roll on, this characteristic aphorism of Lincoln's gains renewed strength, gaining, not by simple, but by compound interest. Pharmacy has no place for the careless, the indifferent, the ignorant. In these days of exacting competition, days in which only the fittest survive, our only safety lies in the monopoly which education and skill gives us. *Higher education is the only earthly power (coupled with attendant legislation) that will protect the profession of pharmacy from ultimate ruin—that is, ruin as far as the retail apothecary is concerned.*

“Pharmacy is a fortress which does not open its doors to a gentle rapping; it succumbs only to persistent assault.” If you have faithfully followed the teachings of this little book, you have but opened the outer door; you stand, perchance, in the narrow hall-way, your gaze bewildered by the numberless doors leading hither and thither. To seek and gain entrance into the *living apartments* of this exacting despot—Pharmacy—you must continue your assaults persistently, until, one by one, the doors that bar your further progress are opened to you. But, as they are *slowly* swung back upon their massive hinges, your impatience asserts itself, and you spring through the open doors before they are hardly opened sufficiently to admit of your passage, and you, in your haste and impatience, become wounded by contact with the sharp edges of the casing. But you have gained entrance and you do not care; instead, you feel exultant. But beware, my friend, lest in your imagined security you should suddenly awake some dark night to find yourself transported back into the narrow hall-way! If you make no effort to retain your position on the crest of the wave, fully aware of your precarious situation, you will be swept beneath its cruel surface.

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